International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 07 | July -2020 ISSN: 2582-3930

GSM BASED SMART IRRIGTION SYSTEMS

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Abstract: ***GSM based Smart Irrigation Systems is developed using IoT Technology with an objective of automating the total irrigation system which provides adequate water required by crop by monitoring the moisture of soil and climate conditions and prevent the wastage of water resource. The GSM module has been used to establish a communication link between the farmer and the field. The current field status will be intimated to the farmer through SMS.***

Key-words: *ARDUINO UNO Microcontroller, Soil moisture sensor, Humidity and Temperature sensor, water level indicator sensor, GSM module, SMS.*

Nomenclatures*: The Global System for Mobile Communications (GSM), Internet of Things (IOT), Short Message Service (SMS), Second Generation (2G), Subscriber Identity Module (SIM).*

I. INTRODUCTION

The agriculture is one of the most fundamental resources of food production and also plays a vital role in keeping the economy running of every nation by contributing to the Gross Domestic Production. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land from time to time. This process sometimes consumes more water. From this Automatic irrigation project it has shown that water can be used effectively by measuring soil moisture and water level in tank or pond which reduces much of manual irrigation time and work.

In this paper, Section I contains the Introduction of present Irrigation methods and how automation technology helps, Section II contains the Literature survey or related work of GSM based Smart Irrigation Systems, Section III explains Methodology with block diagram, control table and flow chart used in implementation of the project, Section IV contains the circuit diagram of the system, results and screenshots and Section V concludes the project with the future scope.

II. LITERATURE SURVEY

In **GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile,** Pavithra D. S, and M. S .Srinath says [1]: In this technology for the first time an android phone-control the Irrigation system, which could give the facilities of maintaining uniform environmental conditions are proposed. The Android Software Development Kit provides the tools and Application Programmable Interface necessary to begin developing applications on the Android platform using the Java programming language. This application makes use of the GPRS [General Packet Radio Service] feature of mobile phone as a solution for irrigation control system. GSM is used to inform the user about the exact field condition in the form of SMS.

In **International Journal of Engineering Research & Technology (IJERT): Smart Irrigation System using IoT: SIS,**Aman Kumar, Ajit Kumar, Praveen Kumar Sharma says [2]: This paper aims at developing the Smart Irrigation System Using IoT Technology with an objective of automating the total irrigation system which provides adequate water required by crop by monitoring the moisture of soil and climate condition in order to prevent the wastage of water resource. It will also have many advantages for farmers. The irrigation at remote location from home will become easy and more comfortable. In addition, it will not only protect the farmer from scorching heat & severe cold but also save their time for to and fro journey to the field.

In **International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)**: **Arduino Based Smart Irrigation**

System,Madhu Vanthi.K, Kavipriya.R, DivyaPriya.D, M.Ambika says [3]: In dry zones or in situation of lacking rainfall, irrigation comes to be difficult. Irrigation management is a hard decision making progression to control when and how much water to relate to a growing crop to meet exact management objectives. A small cost another key for well-organized aquatic checking presently in use is drip irrigation structures that contain of an automatic processor to turn on & off the control values that helps in better crop production.

In **Journal of Advanced Trends in Computer Science and Engineering: A Mobile Phone Controllable Smart Irrigation System,** Olatunji K, Oguntimilehin, Adeyemo O says [4]:
The increase in technological innovation has made it possible to take full advantage of crop production. This research aims to use a smart irrigation system to control water distributed to crops. The system does so by connecting the irrigation system and the user's Smartphone through the internet and automating the process of irrigation with computer programming and micro computing.

From
FINAL_REPORT_DELL_EMC_AUTOMATED_IRRIGATION_SYSTEM [5]**:**
This system will work to minimize the number of workers in a crop field, control and save water and electricity, Increase agricultural production using small quantities of water, minimize manual intervention in watering operations with increasing watering speed and preserving plants from fungi. All these features make these research sustainable options to be considered to improve the agriculture and irrigation efficiency. The purpose of the smart irrigation system for a large scale or small scale and make it smarter and efficient.

Observations of the existing GSM based irrigation systems from the study of above Literature surveys are:

- From the paper [1], the good thing is that whole device is mobile phone controlled using Bluetooth and GSM however it works only for the ***Android Smart phones*** that is because the controlling is doing by means of **Java Application** (in short mobile App). Also in [5], it is observed that to build the system different sensors like Soil Moisture, Light, Temperature, level, rain, flow with different another device water pump, Battery, LCD, Solenoid valve have been used. And the whole system is controlled by a **mobile application**. The projects [1] [5] are controlling by *Mobile applications* (i.e. they rely on smart phones only).

- When it comes to the project [2], here the components that are being used are Soil Moisture sensor, Rain sensor, Relay and Motor, and **WIFI module**. And in the project [3] the components that are using are Temperature and Humidity sensor, soil moisture sensor, Relay and water pump, and **WIFI module**. Also in [4] project, the system does automation of irrigation process by using *Virtuino module* - which is an android application for monitoring sensors or controlling electrical devices via Bluetooth, local Wi-Fi or the internet. The only disadvantage with the projects that works with *Wi-Fi*is that most of the agricultural land is far from the city i.e. remote places or in the midst of mountains so the internet might not be good or catchy in those areas for a person to know the status. Hence using Wi-Fi might not be feasible idea.

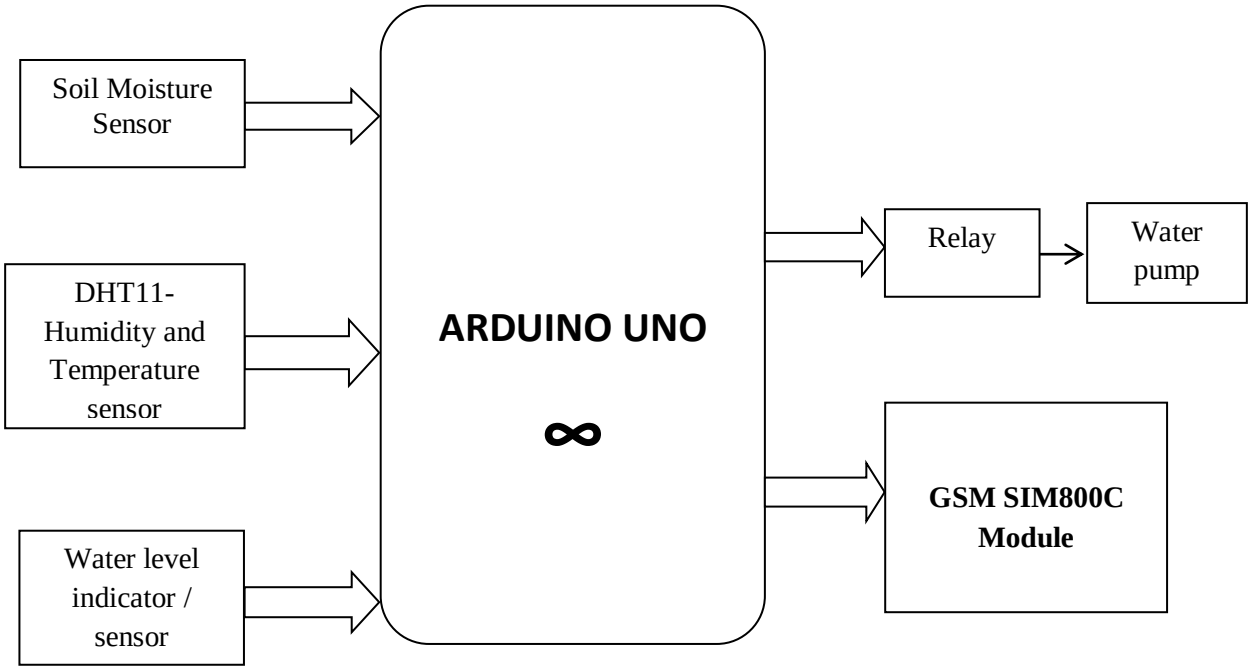
Our proposed system uses neither Wi-Fi module nor the smart phone; the GSM that we are using is SIM800C which works on 2G SIM cards. Any basic handset (mobile phone) that is capable of receiving messages can be used to interact with this system. Currently we are targeting to send the status report to the farmer. It can also be extend to control the system by merely sending SMS from the farmer's mobile to the GSM (smart phones or Apps are not necessarily required).

III. METHODOLOGY

In this system we are using ARDUINO UNO microcontroller which is a heart of the system takes input data from 3 sensors, they are: Temperature and Humidity sensor, Soil moisture sensor and Water level sensor. Based on the value of SOIL MOISTURE and WATER LEVEL it sends command to RELAY module weather to on MOTOR or not.

If the soil moisture is low and tank has at least medium level of water then ARDUINO sends command to relay to ON the motor. In the case if the soil moisture is less but water level is low they motor will remain OFF. Lastly if soil moisture is high then again motor will remain OFF. All the statuses are sending to GSM module to send SMS to the user.

III.I Block Diagram:



III.II Control Table:

Table-1: Shows conditions that needs for a Motor to ON

Soil Moisture Value	Water Level	Motor ON/OFF
Less than 50%	Empty	OFF
Less than 50%	Medium/Full	**ON**
Greater than 50%	Empty/Medium/Full	OFF

III.III Software Used

Arduino IDE Tool version 1.8.12
Arduino IDE tool (software) is an open source environment where we can write a code and upload it on to UNO board. It runs on windows Mac OS and Linux OS.

III.IV Hardware details

Components used for Implementation of the system:

1. *ARDUINO UNO micro controller*
2. *GSM SIM800C modem*
3. *Bread board and jump wires*
4. *Soil moisture sensor*
5. *Temperature and Humidity sensor*
6. *Water level sensor*
7. *Relay module and Water pump*
8. *Laptop*
9. *Mobile phone*

1. **Arduino Board (UNO)**
Arduino UNO is micro-controller based on Atmega328, having 14 digital In/Out pins of which 6 are for PWM output, 6 are for analog input. Operates at 16 MHz, with a USB, Power jack, reset button.

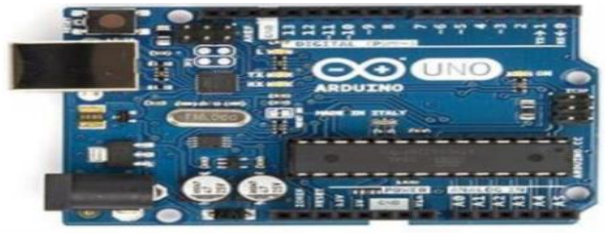


Figure1: Arduino UNO Board

2. **GSM SIM800C MODEM:**
SIMCom offers this information as a service to its customers, to support application and engineering efforts that use the products designed by SIMCom. This 800C works for 2g SIM card only.

Figure2: GSM SIM800C Modem

3. **Bread board and Jump wires:**
A breadboard consists of two areas called *STRIPS*. One is BUS strips and other TERMINAL strips. At most 5 sensors can be connected. Jump wires are used for connections.

4. **Soil Moisture Sensor:**
Soil Moisture Sensor detects the moisture content of soil, it consists of a plurality of soil moisture sensors. Technology used is Frequency domain Sensor i.e., capacitive sensor, moisture meter characteristic of the use of water in the neutron moderator

Figure3: Soil Moisture Sensor

5. **Temperature and humidity sensor:**
This sensor named DHT11 has a resolution of 16bit which measures TEMPERATURE and HUMIDITY of the area that it is used.

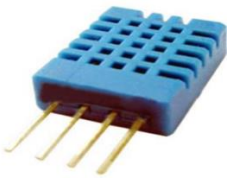


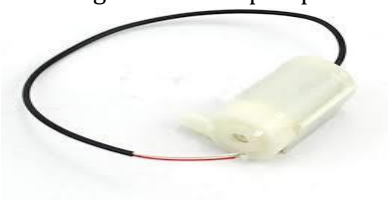
Figure4: DHT11 Sensor

6. **Water level sensor;** This sensor's working is straight forward method. Output result of this will be an integer ranging from '0'and '500'.

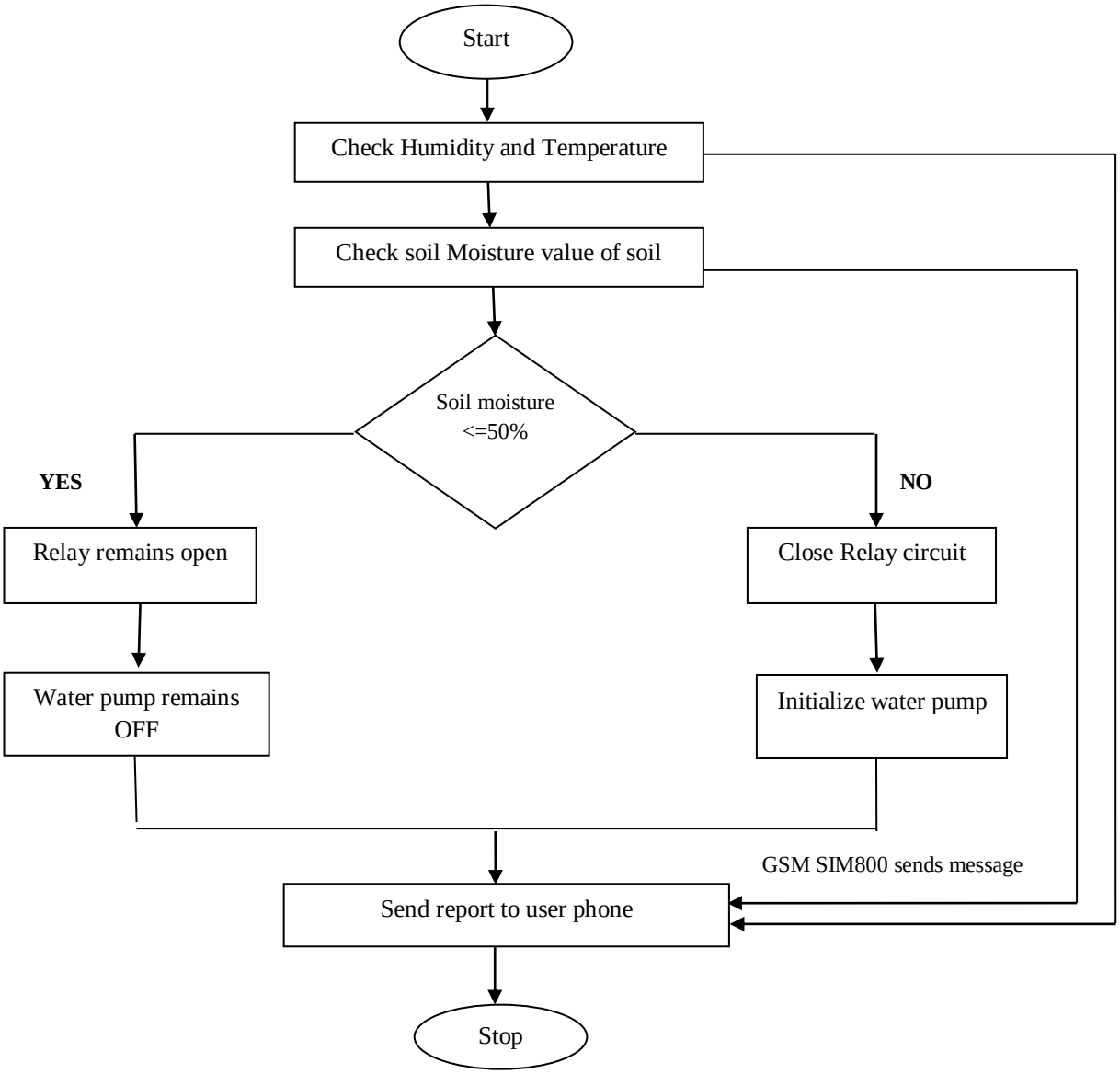
Figure5: Water level indicator

7. **Relay and Water Pump:** The water pump is the part of the system that delivers water to the soil. The motor drive is used to provide power to the water pump as well as interfacing the pump to the Arduino. Relay is used to control the water pump i.e. to ON\OFF.

Figure6: Water pump

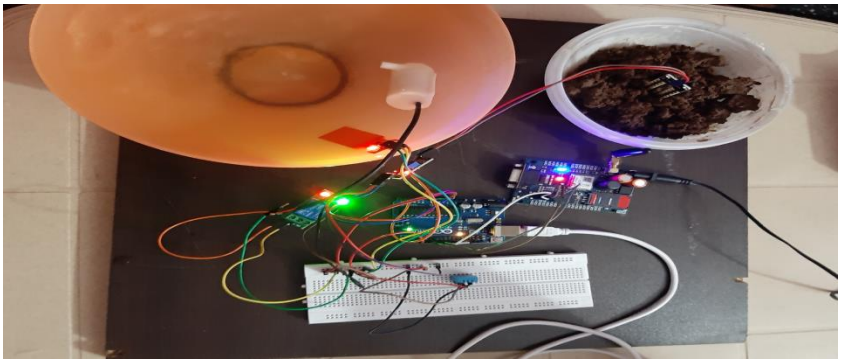


IV.V System Flow Chart:



IV. CIRCUIT DIAGRAM AND RESULTS:

IV.1 Circuit Implementation Diagram



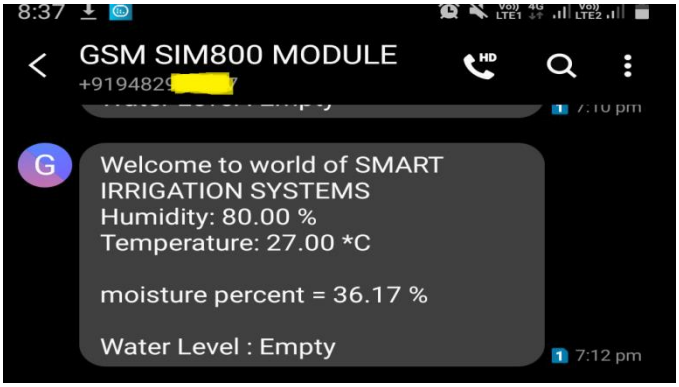
IV.II Results Table

Table2: Explains Parameters (Temperature, Humidity, moisture percentage and water level) at different dates and time.

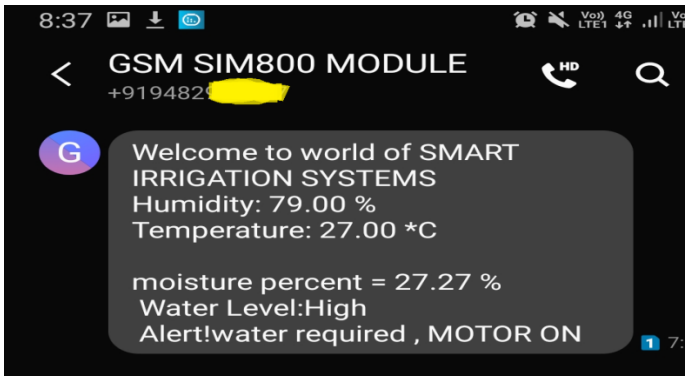
SL No.	Timestamp	Temperature (*C)	Humidity (%)	Soil Moisture (%)	Water Level (Low, Medium, High)
1.	2020-07-04:20:25	28	75	76.34	High
2.	2020-07-04:21:26	27	77	76.44	High
3.	2020-07-04:22:38	27	78	76.54	High
4.	2020-07-05:13:48	27	78	75.95	High
5.	2020-07-05:15:52	27	78	75.12	High
6.	2020-07-06:17:57	30	72	43.37	Medium
7.	2020-07-06:19:10	29	72	36.17	Medium
8.	2020-07-07:19:20	27	79	27.27	Medium
9,	2020-07-07:20:20	27	80	39.10	Low

IV.III Screenshots of Results:

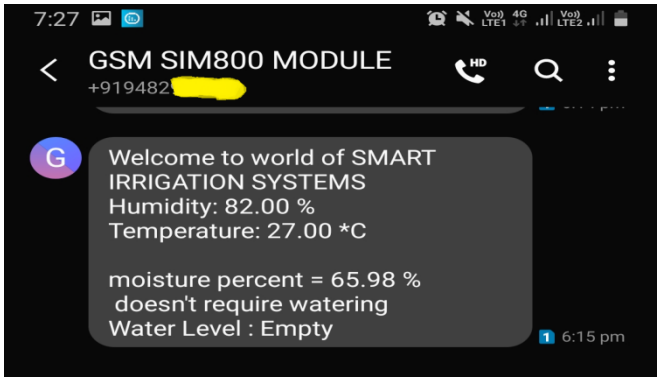
- ✓ Senario1: Soil moisture is LOW but water level is empty hence MOTOR will remain OFF



- ✓ Senario2: Soil Moisture is LOW and water level is HIGH hence MOTOR is ON.



- ✓ **Senario3: Soil Moisture is HIGH hence MOTOR is OFF.**



V. CONCLUSION AND FUTURE WORK

The main objective of this projectis to make irrigation process flexible, time saving and more efficient than the existing system. With the sensor values one can know the present of soil moisture, temperature and humidity of the field and water level in the tank/small pond. On basis of these values water flow is monitored and these information is sending to user mobile by GSM module. Since the system is automatic, they do not require continuous attention and monitoring. So this eliminates much of the human efforts which are a stress free for a farmer. Overall this system avoids over irrigation, under irrigation, and reduces the wastage of water. The main advantage is that the system's action can be implemented with low power, low cost, small size, robust and highly versatile. In large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands. This

system is cheaper and efficient when compared to other type of automation system.

The future scope of this project would be first since the whole circuit works only on power supply, in case of power cuts or damage a battery or solar power unit can be implemented as an alternative source. And the second, the smoke sensors can use to send emergency information to user in case of fire in field or burning of motor.

References

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